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Rev. R. Main, President, in the Chair.

Rev. Dr. Booth, Incumbent of Stone, Bucks;
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F. H. Elliott, Esq., 56 Strand;
Thomas Cooke, Esq., York;
Rev. Francis Redford, Silloth by Carlisle; and
J. E. Richard, Esq., West Hill, Wandsworth,

were balloted for and duly elected Fellows of the Society.

Occultation of Saturn by the Moon on May 8, *as observed at the Cambridge Observatory.* By Professor Challis.

The observations were taken by myself and my senior assistant, Mr. Bowden. I employed the Northumberland telescope, with a magnifying power of 215, the junior assistant, Mr. Christy, counting the seconds from a sidereal clock; and Mr. Bowden observed with the telescope of the 5-feet equatoreal, using a magnifying power of 120. The atmospheric circumstances were favourable. The following are the Greenwich mean times of observation, the letters C and B denoting the observers.

Disappearances.

	C.			B.	
	h	m	s	s	
Contact of Saturn's limb...........	8	17	29·58	......	(*a*)
Complete immersion of Saturn ...	8	17	63·09	59·84	(*b*)
,, ,, of outer ring	8	18	13·66	12·70	(*c*)

Reappearances.

	C.			B.	
	h	m	s	s	
First contact of outer ring	9	16	2·01(?)	......	(*d*)
,, ,, of Saturn...............	9	16	23·95	23·79	(*e*)
Complete emersion of Saturn	9	16	53·47	60·19	(*f*)
,, ,, of outer ring...	9	17	13·81	11·66(?)	(*g*)

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(*a.*) The occultation occurring earlier than was expected, the first contacts of the planet and ring were lost. The time noted by C is that of coincidence of the moon's limb with that point of *Saturn's* limb which was judged to be on the axis major of the ring. (*b*) and (*c.*) These times were considered to be "good."

(*d.*) This time is very doubtful. The limb of the ring was partially obscured at emergence by the micrometer wires set to indicate where to look for it, and had evidently projected a few seconds of arc from the moon's limb when the time was noted. (*e*) and (*f.*) C's times were considered "pretty certain:" those of B were "extremely unsatisfactory." (*g.*) The limb of the ring appeared to C to separate suddenly from the moon's limb, and the recorded time was thought to be late: B considered his observation of no value, the edge of the moon being badly defined, from an effect of the telescope, it was supposed, and not from atmospheric causes.

The time of disappearance taking me by surprise, I had scarcely an opportunity of making physical observations in addition to notes of time. I remarked, however, that the moon's limb, where it crossed the middle of *Saturn* and his rings, appeared to be unusually curved, and that both the ball and the ring were reduced before disappearance to a very narrow strip of light. The disappearance seemed to linger. I noted also that the moon's limb was fringed by a darkish border; but I have reason to say that this was merely an effect of the Ramsden eyepiece that was used, the planet, in the hurry, not being placed in the middle of the field. Mr. Bowden remarked as follows: "I did not perceive the slightest change in the appearance of *Saturn*, except just before the total disappearance, when the edge of the ring lost its sharpness of definition, and I thought I saw it wave to and fro. I also thought that just before the total disappearance the edge seemed to hang on the moon's limb, and that the final disappearance was retarded."

The circumstances of the reappearance were very favourable for observing physical phenomena. The moon's limb, as seen in the Northumberland telescope, was steady, and the irregularities were sharply defined. I looked particularly to see whether *Saturn's* disk was crossed by a dark band like that noticed at the occultation of *Jupiter* on Jan. 2, 1857. Nothing of the kind was visible. At the place of reappearance the moon's limb was neither depressed nor elevated, but accorded with the general contour. When the planet was a little separated from the moon's limb, a regular increase of its brightness from the parts nearest the limb to the parts more remote was very observable, and was probably the effect of the dispersed light, which in a telescope is usually seen near the moon's bright limb. The colour of the planet, which very much resembled that exhibited by *Jupiter* at the occultation above mentioned,

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was in remarkable contrast with the whiteness of the moon's light. Mr. Bowden described it as "a dull earthy colour."

From calculations of the occultation made according to the formulæ given in the appendix to the *Nautical Almanac* for 1854, I have obtained results as follows. Let x and y be the corrections of the tabular R.A. (in arc) and tabular N.P.D. of the moon's centre; e and f the like quantities for *Saturn's* centre; $S \times (1 + 0{\cdot}001\,n)$ the moon's true apparent semi-diameter; c the distance of *Saturn's* centre from the moon's limb; D the distance between the centres. Then the tabular quantities being calculated from the *Nautical Almanac* for the Greenwich mean time, $8^{h}\ 18^{m}\ 3^{s}{\cdot}09 + t$, and the latitude and longitude of the observatory, and the moon's parallax being assumed to require no correction, the following equation of condition was obtained,

$$S + c - \text{☽} + 0{\cdot}465\,t = -\,0{\cdot}612\,x - 0{\cdot}774\,y + 0{\cdot}609\,e + 0{\cdot}764\,f - 0{\cdot}985\,n$$

The values of c for the contacts of *Saturn* were calculated from the equatoreal diameter adopted in the *Nautical Almanac*, and an assumed ellipticity of $\frac{1}{13}$; and the value for the contact of the ring was calculated from the data in p. 510 of the *Nautical Almanac* for 1859. The three values were found to be $+4''{\cdot}72$, $-8''{\cdot}30$, and $-12''{\cdot}24$. Hence the numerical value of the left-hand side of the above equation as given by C's three observations is $-2''{\cdot}04$, $+0''{\cdot}61$, and $+1''{\cdot}58$; and as given by B's two observations, $-0''{\cdot}90$ and $+1''{\cdot}13$.

The analogous equation of condition for the reappearance, calculated for the Greenwich mean time $9^{h}\ 16^{m}\ 38^{s}{\cdot}3 + t$ is the following,—

$$S + c - \text{☽} - 0{\cdot}494\,t = +\,0{\cdot}944\,x + 0{\cdot}098\,y - 0{\cdot}939\,e - 0{\cdot}092\,f - 0{\cdot}983\,n$$

The values c calculated for the four contacts from the same data were found to be $\mp 19''{\cdot}75$ and $\mp 8''{\cdot}71$; and accordingly the numerical value of the left-hand side of the equation, as given by C's four observations is, $-4''{\cdot}35$, $-3''{\cdot}50$, $+0''{\cdot}21$, $+1''{\cdot}80$; and as given by B's three observations, $-3''{\cdot}37$, $-3''{\cdot}11$, $+2''{\cdot}86$.

These results are not all entitled to the same weight. For instance, C's first time, from the nature of the observation, was liable to error; and B's time for the complete immersion of *Saturn* is plainly too early, probably by an error in recording. Omitting these, the mean result for the other three times is $+1''{\cdot}11$. Again, the first of C's times of reappearance, and the last of B's, may be rejected, as being considered at the time of no weight; and the remainder will then give the mean result $-1''{\cdot}59$. Thus the two equations of condition become,

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$$+1{\cdot}11 = -0{\cdot}612\,x \quad -0{\cdot}774\,y \quad +0{\cdot}609\,e \quad +0{\cdot}764\,f \quad -0{\cdot}985\,n$$

$$-1{\cdot}59 = +0{\cdot}944\,x \quad +0{\cdot}098\,y \quad -0{\cdot}939\,e \quad -0{\cdot}092\,f \quad -0{\cdot}983\,n$$

These equations, which assume the correctness of the dimensions of *Saturn* and his ring given in the *Nautical Almanac*, might be used to find n when x, y, e and f are known.

On the Present State of the Controversy respecting the Amount of the Acceleration of the Moon's Mean Motion.

By the Rev. R. Main, President.

There is probably no astronomical subject in which the advance or improvement within the last twenty-five years has been so great as in the lunar theory, and in the means taken for increasing the number of observations necessary for bringing the theory to perfection. To begin with observations: during the whole of this period the moon has been observed at Greenwich on the meridian with inflexible rigour, and with an amount of precision which was never previously attempted; and during a portion of it, that is, since the year 1847, a series of observations have been made by an instrument especially designed for the purpose, by which the gaps in the meridian observations, necessarily occurring for about three hours before and three hours after each conjunction, have been in a great measure filled up. These results of observation are, of course, independent of those obtained at other great observatories, which are, on the whole, not inconsiderable, though of very inferior importance.

But, however remarkable be the quantity of materials for the correction of the lunar orbit during the latter portion of the present century, the use which has been made of them is still more so. The gigantic work undertaken by the Astronomer Royal, of reducing, on a uniform plan and with the best modern elements, the whole of the lunar observations made by his predecessors, for a period of eighty years, namely, from 1750 to 1830, comes first in order, as more nearly related to the observations, and is, perhaps, absolutely first in order of importance. The first result from the publication of these observations was the discovery, by Professor Hansen, of the long inequality produced by *Venus*, and the second has been the completion of his invaluable Tables. It is too early to predict that the errors of these tables in all parts of the orbit are so small that all future improvements may be considered to belong to speculative rather than practical science; but this is known already, that, in a rigorous comparison of the *Greenwich Observations* for the year 1852, the errors rarely exceed those which might be due in a great measure to faulty observations; and the scientific public will look with great interest and anxiety for the results of the completion of Mr. Hind's